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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/180,340	08/20/99	HO N	7024109PUR48

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EXAMINER	
ROBINSON, H	
ART UNIT	**PAPER NUMBER**
1653	6

DATE MAILED: 04/12/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/180,340	Applicant(s) Ho et al.
	Examiner Hope Robinson	Group Art Unit 1653

☒ Responsive to communication(s) filed on *Aug 20, 1999* .

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-30* is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-30* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☒ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☒ received in Application No. (Series Code/Serial Number) *PCT/US97/07663* .

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____ .

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *5*

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed on August 20, 1999 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP 609 because there is an item listed on the information disclosure statement that was not translated. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. A line has been drawn through the following item on the information disclosure statement: DE4009676A1 (German language document, without an English abstract).

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 13 is rejected under 112, second paragraph as failing to distinctly point out the subject matter applicant regards as his invention because the claim recites the word "at" twice in line 19. Correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-13 are rejected under 35 U.S.C. 102 (a) as being anticipated by Ho et al. (WO95/13362, May 18, 1995).

Ho et al. teach recombinant yeasts containing genes encoding xylose reductase, xylitol dehydrogenase and xylulokinase, and DNA molecules, vectors and methods useful for producing such yeasts. The recombinant yeasts effectively ferment xylose to ethanol, and preferred yeasts are capable of simultaneously fermenting glucose and xylose to ethanol thereby taking full advantage of these two sugar sources as they are found in agricultural biomass (see abstract and page 3). The reference also teach the fermentation of glucose to ethanol via the yeast *Saccharomyces* (see pages 3-5). Ho et al. indicate that the yeast of the invention can ferment the two sugars (xylose and glucose) to ethanol simultaneously achieved where the xylitol

dehydrogenase, xylulokinase and xylose reductase genes are fused to promoters which are not inhibited by the presence of glucose and also do not require xylose for induction (see page 6). In addition, the recombinant yeast strain containing xylitol dehydrogenase, xylulokinase and xylose reductase genes are fused to non-glucose-inhibited promoters and the yeast is capable of fermenting xylose to ethanol and glucose to ethanol (see page 6). The genes that are fused to promoters in the above case are not inhibited by glucose and do not require xylose for induction, so as to enable the expedient production of recombinant yeasts capable of simultaneously fermenting glucose and xylose to ethanol (see page 7).

Ho et al. teach direct amplification of the intact xylitol dehydrogenase gene and the promotor less xylitol dehydrogenase from *Pichia stipitis* chromosomal DNA (see Figure 10 and page 10). Furthermore, Ho et al. disclose that suitable sources of xylitol dehydrogenase, and xylose reductase genes include xylose-utilizing yeasts such as *Candida shehatae, Pichia stipitis, Pachysolen tannophilus* and suitable sources of xylulokinase genes include the above yeasts as well as xylose non-utilizing yeasts such as those from genus *Saccharomyces cerevisiae*, *Schizosaccharomyces pombe* and bacteria such as *Escherichia coli* etc. (see page 13). Additionally, the reference teaches that pLSK15, a derivative of pLX10-14 is a low copy number plasmid with a copy number of approximately 10 in yeast (*Saccharomyces*). pLSK15 contains the geneticin resistance gene and ampicillin resistance gene which serve as selection markers in *S. cerevisiae* (see pages 15 and 16). pUCKm10 another high copy number plasmid (copy number of about 50 or more) with a copy number close to 100 in *S. cerevisiae*. These specific DNA

fragments serve as the replicon and selection markers that enable the plasmid to be replicated autonomously in *S. cerevisiae* and other yeast and enable the yeast transformants containing the plasmid to be distinguished from the untransformed host cells (see page 16). Therefore, the limitations of the claims are met by Ho et al.

4. Claims 14-16, 18-19 and 28 are rejected under 35 U.S.C. 102 (b) as being anticipated by Le Dall et al. (Current Genetics, vol. 26, pages 38-44, 1994).

Le Dall et al. disclose the construction of several plasmids to test gene amplification in the rDNA by using an EcoRI-Bg*l*II fragment of the G unit of the rDNA of *Y. lipolytica*. The reference provides a plasmid containing Ura3 gene, and the XPR2 gene encoding alkaline extracellular proteinase integrated into a ribosomal RNA gene of *Y. lipolytica*. Le Dall et al. tested transformants containing plasmids for copy number, stability, chromosomal localization and alkaline extracellular protease secretion. Multiple copies of the plasmid were successfully integrated into the genome and cells which expressed the Ura3 gene could be maintained in non-selective medium for at least 20 generations. Further Le Dall et al. asserts that the plasmids contain a portion of the rDNA of *Y. lipolytica* as well as derivatives of the *Y. lipolytica* URA3 gene as selection markers. These derivatives contain various promoter deletions either coupled, or not coupled, to a mutation in the coding region. In addition, these plasmids contained the XPR2 gene used as a model for gene expression and protein secretion (see abstract, and pages 38-39 and 43-44). Therefore, the limitations of the claims are met by this reference.

5. Claims 14-16, 18, 19, 28 and 30 are rejected under 35 U.S.C. 102 (a) as being anticipated by Lopes et al. (Yeast, vol. 12, no.5, pages 467-477, April 1996).

Lopes et al. teach numerous plasmid containing various genes integrated into a ribosomal RNA gene of Saccharomyces cerevisiae. Multiple copies of the plasmid were successfully integrated into the genome; cells were maintained in non-selective medium for multiple generations and stability of the integrated genes was assessed (see abstract and pages 467-475). Further, the plasmids contained a Leu2d selection marker and various cloned genes for stability and expression studies. Yeast transformants were selected by plating on agar plates containing yeast nitrogen base (without amino acids), glucose and histidine. The same medium was used for growing the transformants in liquid culture (see page 468 and Figure 1). Therefore, the claim limitations are met by this reference.

6. Claims 14-16, 18, 19, 28 and 30 are rejected under 35 U.S.C. 102 (b) as being anticipated by Fujii et al. (Applied and Environmental Microbiology, vol. 56, no. 4, pages 997-1003, April 1990).

Fujii et al. teach an integration plasmid, pIARL28 containing the ribosomal DNA gene constructed for introduction of the α-acetolactate decarboxylase gene into brewer's yeast. The transformation efficiency of pIARL28 was 20-50 fold higher than those of other Yip vectors, as yeast cells had approximately 140 copies of the ribosomal DNA gene (see abstract and pages 997-998). The reference also teach that multiple copies of the plasmid was successfully integrated into

the genome of a strain of brewer's yeast; cells which expressed the exogenous gene at low levels and had excised the marker sequences could be maintained in non-selective medium for over 80 generations. Furthermore, integrants were selected on the basis of uracil prototrophy or resistance to G418, respectively. The number of transformants obtained with the KpnI-linearized plasmid was more than 20-50 fold higher than that obtained with the ApaI-linearized plasmid. Fujii et al. interpret these results to mean that the rDNA genes were useful target sequences because they enhanced integration efficiency due to their high copy number in the genome (see page 998, and Figure 1). Therefore, this reference meets the limitations of the claims.

Claim Rejections - 35 U.S.C. § 103

The following is a quotation of 35 U.S.C. 103 (a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103 (a), the examiner presumes that the subject matter of the various claims was

commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103 (c) and potential 35 U.S.C. 102 (f) or (g) prior art under 35 U.S.C. 103 (a).

8. Claims 1-30 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Yamano et al. (Journal of Biotechnology, vol. 32, pages 173-178, 1994) in view of Le Dall et al. (Current Genetics, vol. 26, pages 38-44, 1994), Fujii et al. (Applied and Environmental Microbiology, vol. 56, no. 4, pages 997-1003, April 1990) and Tantirungkij et al. (Applied Microbiology Biotechnology, vol. 41, pages 8-12, 1994).

The teachings of Le Dall et al. and Fujii et al. are above. Yamano et al. disclose a plasmid containing an *Acetobacter aceti ssp. xylinum* α-acetolactate decarboxylase (ALDC) gene integrated into a ribosomal RNA gene of brewer's yeast (*Saccharomyces carlsbergensis*; ribosomal genes are known to integrate as multiple copies). The plasmid was successfully integrated into the genome of a strain of brewer's yeast and cells which expressed the exogenous gene could be maintained in non-selective medium for over 60 generations. Further the cells were co-transformed with a plasmid for G418 resistance (pZNEO) (see abstract and pages 173-178). Yamano et al. teach that the proportion of ALDC positive clones was highest when the ratio of the ALDC integration cassette to pZNEO was 3:1 (see pages 177-178). Neither Le Dall et al.,

Fujii et al. or Yamano et al. teach a yeast containing genes for xylose fermentation multiply integrated into the ribosomal genes.

Tantirungkij et al. mutants of xylose-assimilating recombinant *Saccharomyces cerevisiae* carrying the xylose reductase and xylitol dehydrogenase genes on plasmid pEXGD8 were selected. High xylulokinase activity was reported in the fastest growing strain (IM2). Further, the reference teach that the slow conversion of xylose to xylitol led to an increase in the ethanol yield (see abstract).

Therefore, it would have been obvious to one of ordinary skill in the art to arrive at the invention as a whole by combining the teachings of the above references because Le Dall et al., Fujii et al. and Yamano et al. all teach plasmids containing various genes integrated into a ribosomal RNA gene of brewer's yeast and multiple copies of the plasmid integrated into the genome. There is motivation to combine the references based on the similarity of the teachings and Fujii et al. incorporates the teachings of Yamano et al. In order to obtain a higher copy number of the genes for xylose assimilation and thus higher expression levels than observed by Tantirungkij et al. it would have been obvious to modify the teachings of Fujii et al., Le Dall et al. and Yamano et al. by adding in the xylose-assimilating recombinant yeast of Tantirungkij et al. Because Tantirungkij et al. describes recombinant Saccharomyces cerevisiae which contain and express the genes for xylose assimilation integrated into the genome. Although Tantirungkij et al. does not teach integration into ribosomal genes it would have been obvious for one of ordinary skill in the art at the time the invention was made to place the xylose assimilation genes into a

ribosomal integration vector, as taught by Yamano et al., Le Dall et al. and Fujii et al. with a reasonable expectation of success. Thus, the claimed invention was obvious to make and use at the time it was made and was *prima facie* obvious.

9. Claims 1-30 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Ho et al. (WO 95/13362, May 18, 1995) in view of Le Dall et al. (Current Genetics, vol. 26, pages 38-44, 1994), and Fujii et al. (Applied and Environmental Microbiology, vol. 56, no. 4, pages 997-1003, April 1990).

The teachings of Le Dall et al. and Fujii et al. are discussed above. Neither Le Dall et al. or Fujii et al. describes yeast containing the genes for xylose fermentation multiply integrated into the ribosomal genes. Ho et al. as applied to Claims 1-13 is above and is applied to this rejection in summary. Ho et al. discloses recombinant Saccharomyces cerevisiae which contain and express the genes for xylose assimilation integrated into the genome. Therefore, it would have been obvious to one of ordinary skill to place the xylose assimilation genes of Ho et al. into the ribosomal vector of Le Dall et al. and Fujii et al. with a reasonable expectation of success.

Thus, the claimed invention was obvious to make and use at the time it was made and was *prima facie* obvious.

Art of *Record*

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Hallborn et al. (U.S. Patent No. 5,886,382, November 3, 1994). Hallborn et al. teach recombinant DNA technology, specifically new recombinant yeast strains transformed with xylose reductase and/or xylitol dehydrogenase enzyme genes. A yeast strain transformed with the xylose to xylitol and consequently of producing xylitol in vivo. If both of these genes are transformed into a yeast strain, the resultant strain is capable of producing ethanol on xylose containing medium during fermentation.

Ho et al. (U.S. Patent No. 5,789,210, November 8, 1993). Ho et al. teach recombinant yeast containing genes encoding xylose reductase, xylitol dehydrogenase and xylulokinase, and DNA molecules, vectors and methods useful for producing such yeasts.

Conclusion

11. No claims are allowable.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hope Robinson whose telephone number is (703) 308-6231. The examiner can normally be reached on Monday-Friday from 9:00 am to 5:30 pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christopher S. F. Low, can be reached at (703) 308-2923.

Any inquiries of a general nature relating to this application should be directed to the Group Receptionist whose telephone number is (703) 308-0196.

Papers related to this application may be submitted by facsimile transmission. The official fax phone number for Technology Center 1600 is (703) 308-4242. Please affix the examiner's name on a cover sheet attached to your communication should you choose to fax your response. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG (November 15, 1989).

Hope Robinson, MS

Patent Examiner

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